An Adaptive Root-Solving Controller For Tracking Of Nonlinear Dynamic Plants

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Summary

Adaptive tracking of nonlinear dynamic plants is currently an important area of research. The main difficulty being felt by the research community is the lack of a general modelling framework that can facilitate synthesis of a simplistic control law, while being capable of providing accurate approximation of nonlinear systems. In this study a novel technique based on the control-oriented U-model is proposed for the adaptive tracking of a wide range of stable nonlinear dynamic plants using only past data. The basic scheme is based on the robust internal model control (IMC) structure. An adaptive version of the U-model is introduced for the modelling of the plant and a simplistic control law based on polynomial root-solving is synthesized. The proposed scheme has a more general appeal than other adaptive schemes based on models such as the polynomial NARMAX (nonlinear autoregressive moving average with exogenous inputs) model. Additionally, the control law is much simpler in nature. The effectiveness of the proposed adaptive scheme is demonstrated through application to the real-time control of a single-link robotic arm manipulator and simulations for different nonlinear plants.